

Abstract

An improved Bernoulli end effector for holding, handling, and transporting ultra-thin substrates includes edge guides to aid in the positioning of the substrate and may include friction pads that impede motion of the substrate lifted by the end effector. The Bernoulli end effector may be incorporated into an apparatus and method for supinating a substrate so that both surfaces of the substrate can be processed. In addition, the Bernoulli end effector may be used to place ultra-thin substrates on and retrieve substrates from a substrate handling structure that includes weights that prevent the substrates from bowing or flexing during processing and includes guides that prevent the ultra-thin substrates from moving or translating on the surface of the substrate handling structure.

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